



# Solar Energy Development on DoD Installations in the Mojave & Colorado Deserts

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## **SOLAR ENERGY DEVELOPMENT ON DEPARTMENT OF DEFENSE INSTALLATIONS IN THE MOJAVE AND COLORADO DESERTS**

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## Report Status

- Report is in the midst of DoD-wide review
  - 219 comments received thus far
- All results discussed today are draft/provisional
- Final report expected to be released in January

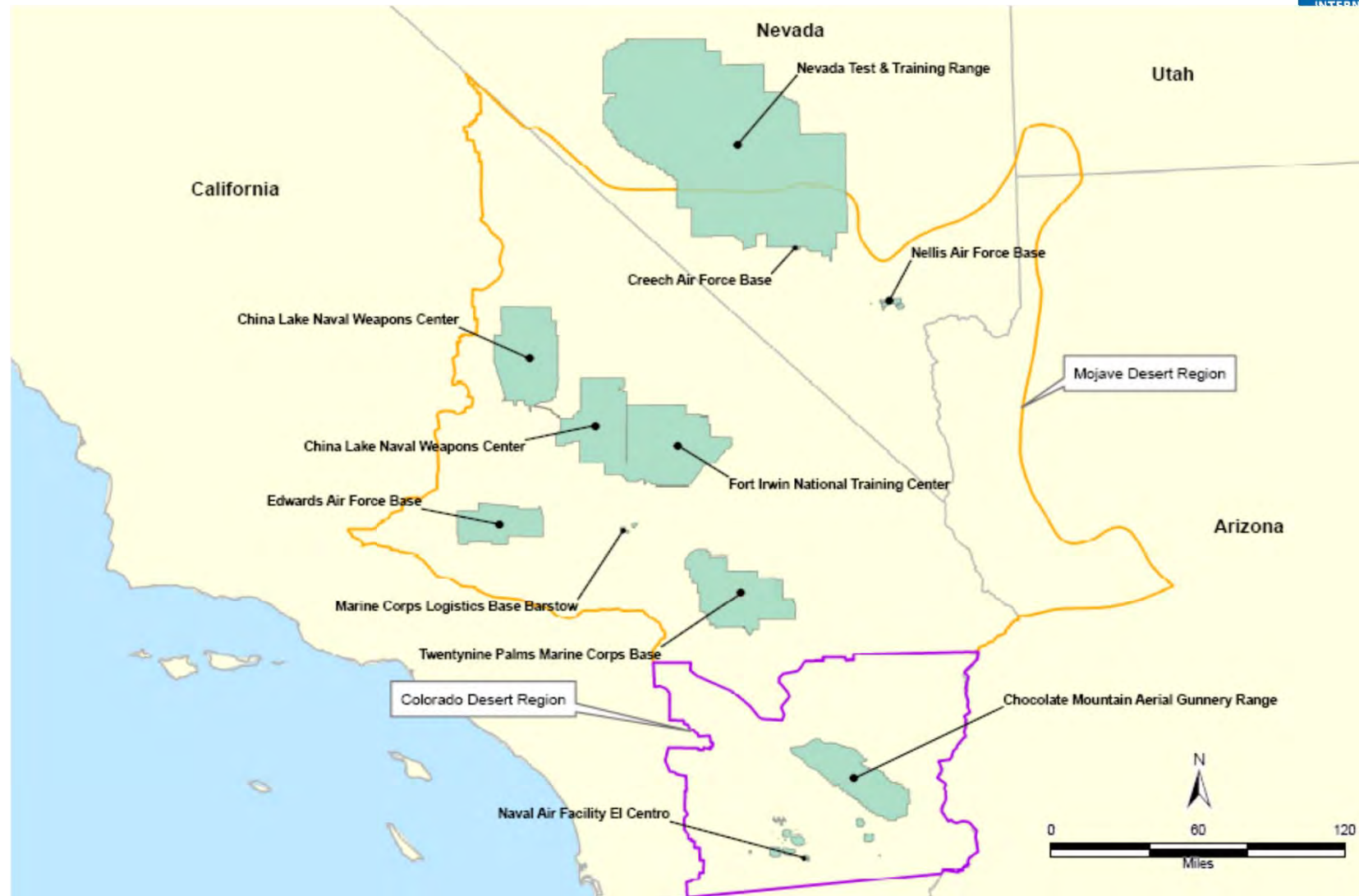
## Agenda

- Key Findings
- Nine Installations in the Study
- Results of Solar Potential Assessment
- Analytical Process
- Conclusions and Recommendations

## Key Findings

- 10-20,000 megawatts (MW) of solar energy development is technically feasible and financially viable
- 92% of the surface area of the CA installations is technically infeasible due to conflicts (mission, slope, flood hazard, biological & cultural resources)
- Private developers can tap the solar potential with no capital investment requirement from DoD
- Fed Government could potentially receive approximately \$260 million/year in rental payments/reduced cost power
- Technical, policy and programmatic barriers exist (transmission, withdrawn land management)

## Nine Installations in the Study



***Study restricted to land inside installation boundaries including Withdrawn Lands.***

## Nine Installations in the Study

Table ES.8 – Withdrawn Lands			
Base	Acres Withdrawn	Total Acres	Withdrawn %
<b>Edwards AFB</b>	83,110	308,123	27%
<b>Fort Irwin</b>	725,062	754,134	96%
<b>China Lake</b>	1,108,956	1,108,956	100%
<b>Chocolate Mtn.</b>	226,711	463,108	49%
<b>El Centro</b>	47,870	56,289	85%
<b>29 Palms</b>	472,649	595,578	79%
<b>MCLB Barstow</b>	3,683	6,176	60%
<b>Nellis AFB</b>	10,290	14,000	74%
<b>Nevada T&amp;TR</b>	2,919,890	2,919,890	100%
<b>Creech AFB</b>	2,940	2,940	100%
<b>Total</b>	5,601,161	6,228,543	90%

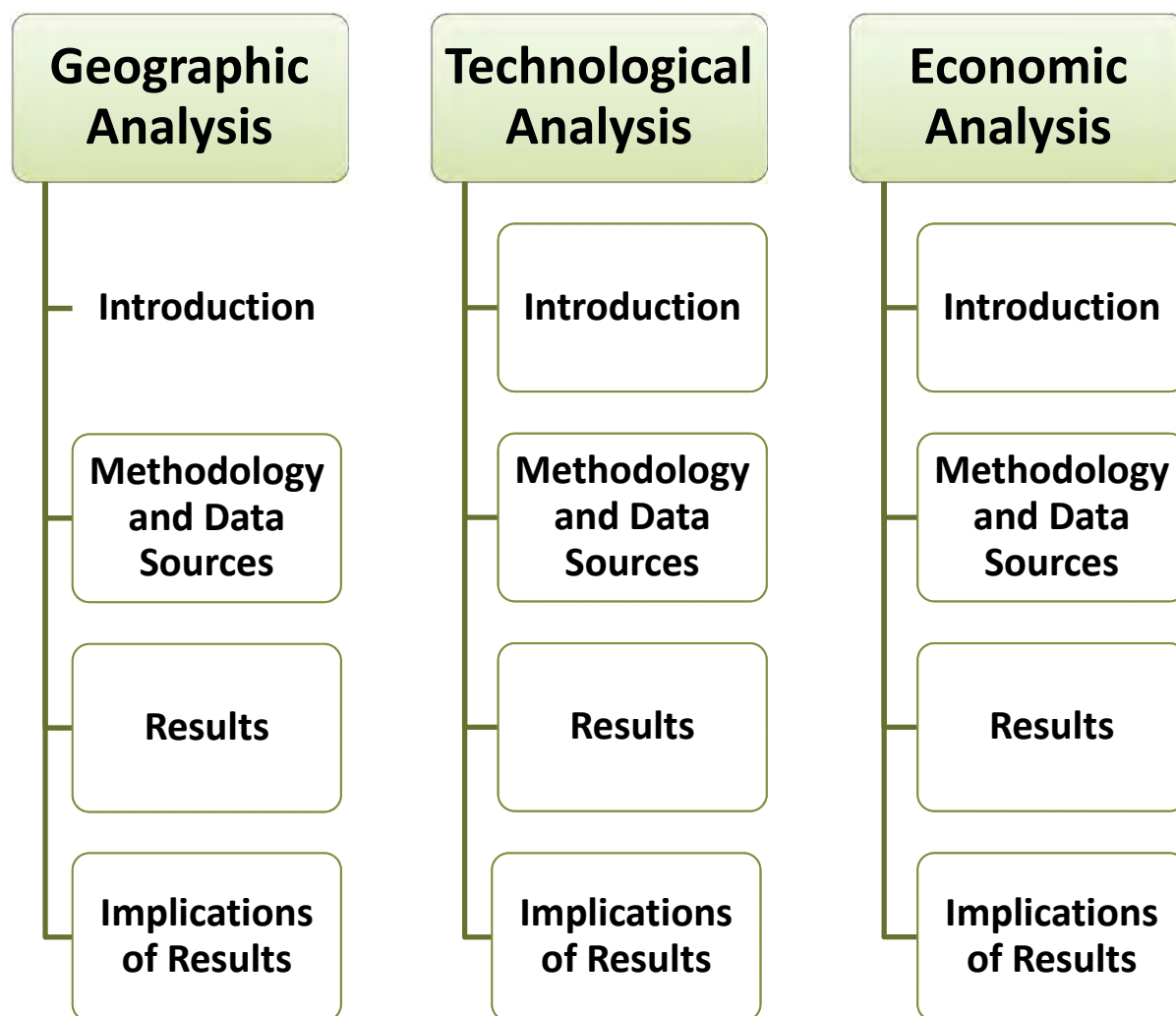
Most installations already have 1-2 megawatts (MW) of solar energy  
Existing and Planned Solar Projects >5MW

Developer	Base	State	Nameplate capacity (MW)	Technology Type	Finance Method	Status	Completion Date
Clark Energy Group and Acciona Solar	Fort Irwin	CA	500	Concentrating and Crystalline Silicon PV	Enhanced Use Lease	Assessment	2022
Fotowatio Renewable Ventures	Edwards Air Force Base	CA	500	Crystalline Silicon PV	Enhanced Use Lease	Planned	Unknown
SunPower	Nellis Air Force Base	NV	14.2	Crystalline Silicon PV	Power Purchase Agreement	Completed	2005
Not Yet Identified	Nellis Air Force Base	NV	18	Crystalline Silicon PV	X	Proposed	2011
Not Yet Identified	NAWS China Lake	CA	13	Crystalline Silicon PV	Power Purchase Agreement	Proposed	Unknown
Not Yet Identified	Twentynine Palms	CA	40-50	Crystalline Silicon PV	Power Purchase Agreement	Proposed	Unknown

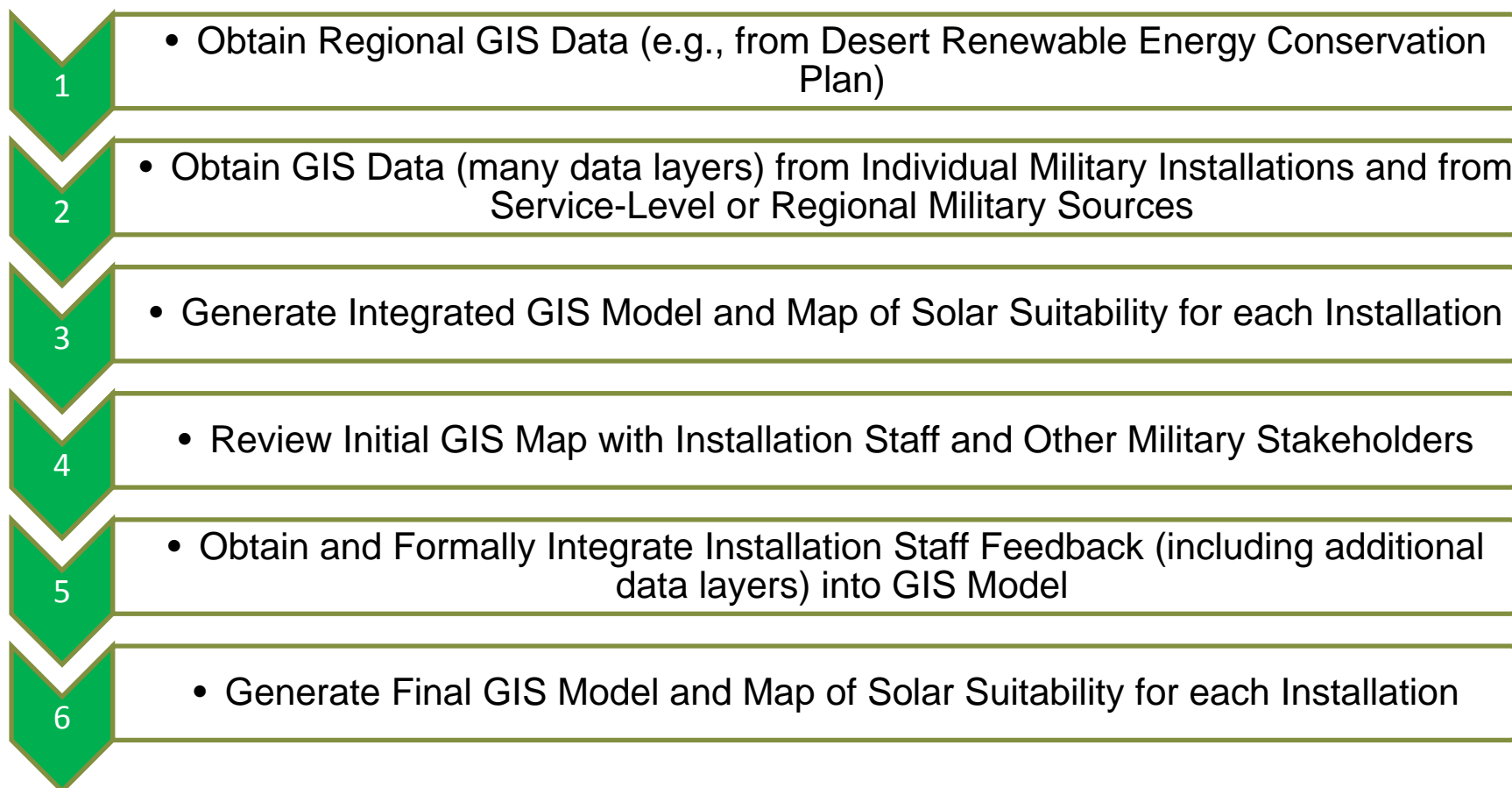
## Results of Solar Potential Assessment

- 10-20,000 MW<sub>AC</sub> of potential solar capacity in CA (NV has little potential)
  - 99.9% ground mount
  - 0.1% roof mount
- Acreage:
  - ~6.2 million acres on 9 installations
  - 250,000 acres with some level of suitability for solar
  - 120,000 acres are estimated with technical & economic potential
- 23 M metric tons of annual CO<sub>2</sub> emissions reductions
- \$260 M in annual rent to the Federal Government
  - ~\$2,250/acre per year in rent

# Analytical Process



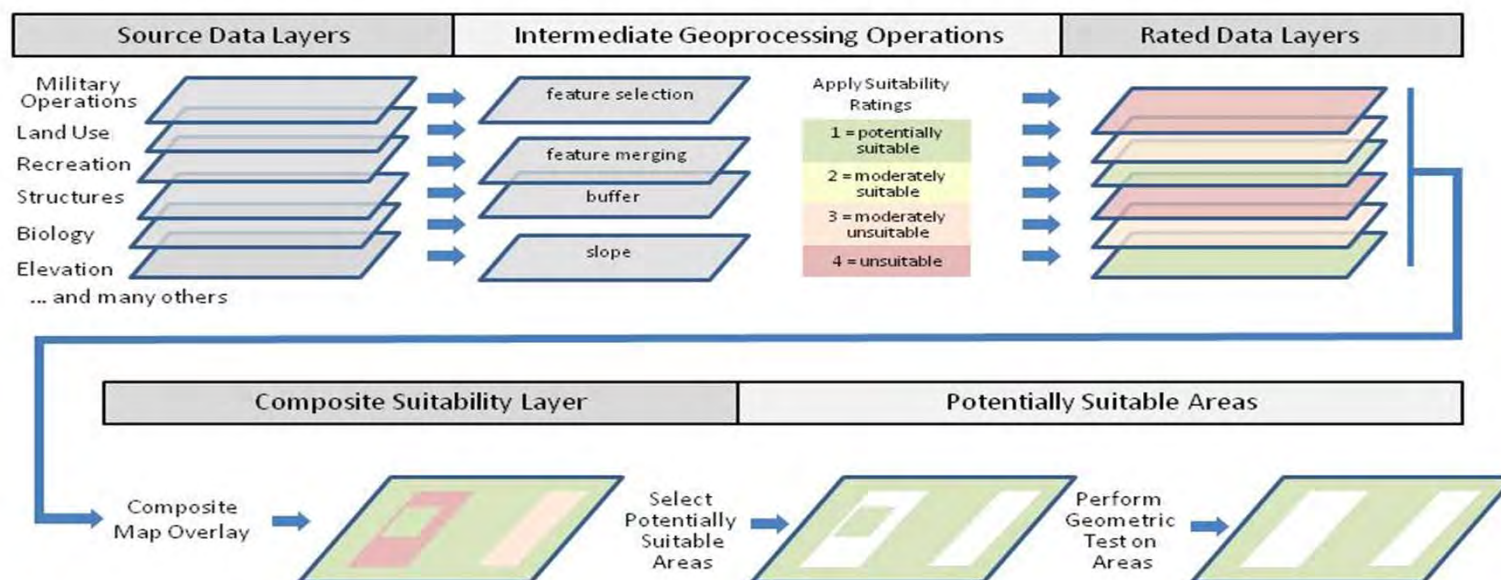
## Geographic Analysis Steps



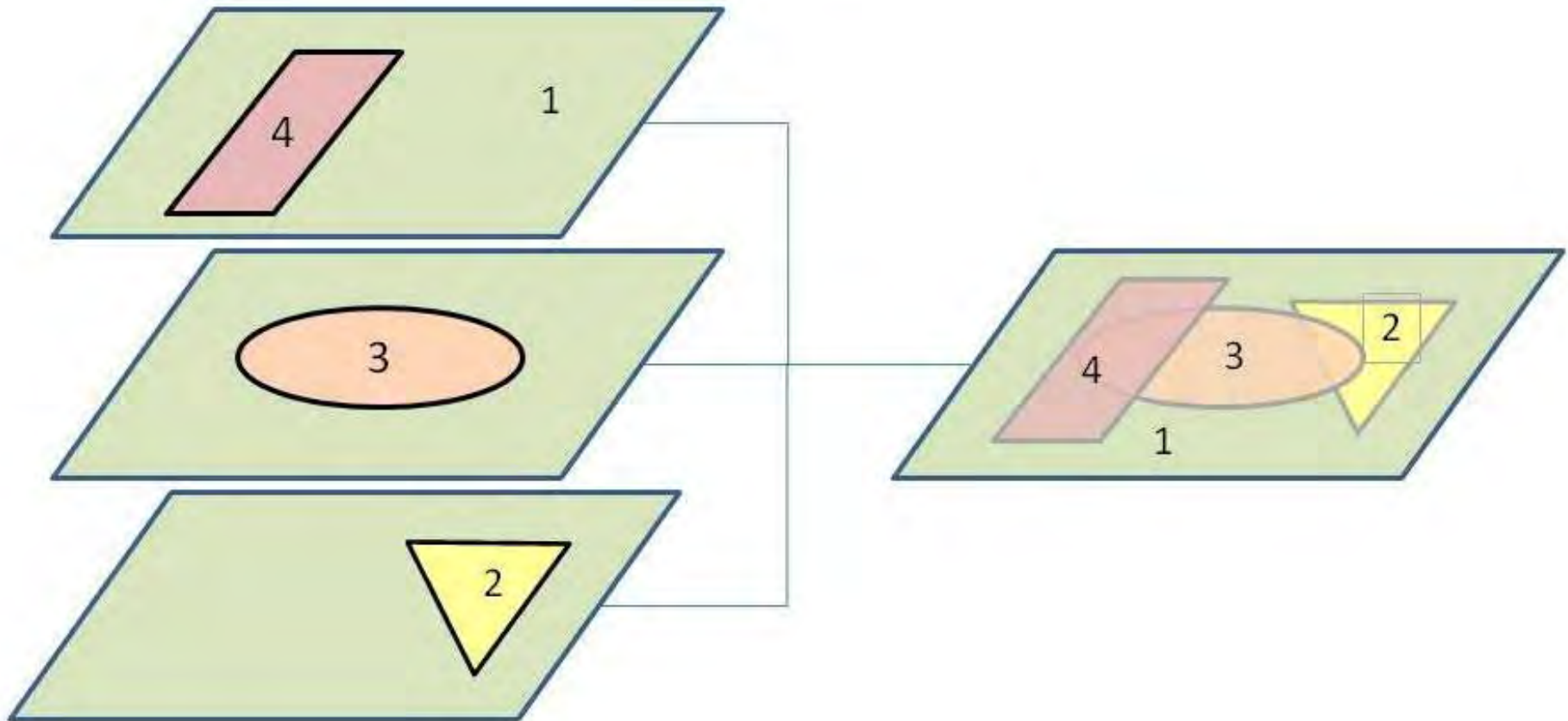
**Only Conducted for California Installations**

# Geographic Analytic Process

- Five distinct “site types”
  - Rooftops, paved parking lots, unpaved parking lots, cantonment ground sites and, range ground sites
  - Geographic Information System techniques used to overlay 20 to 40 independent variables per installation
  - Suitability rating established



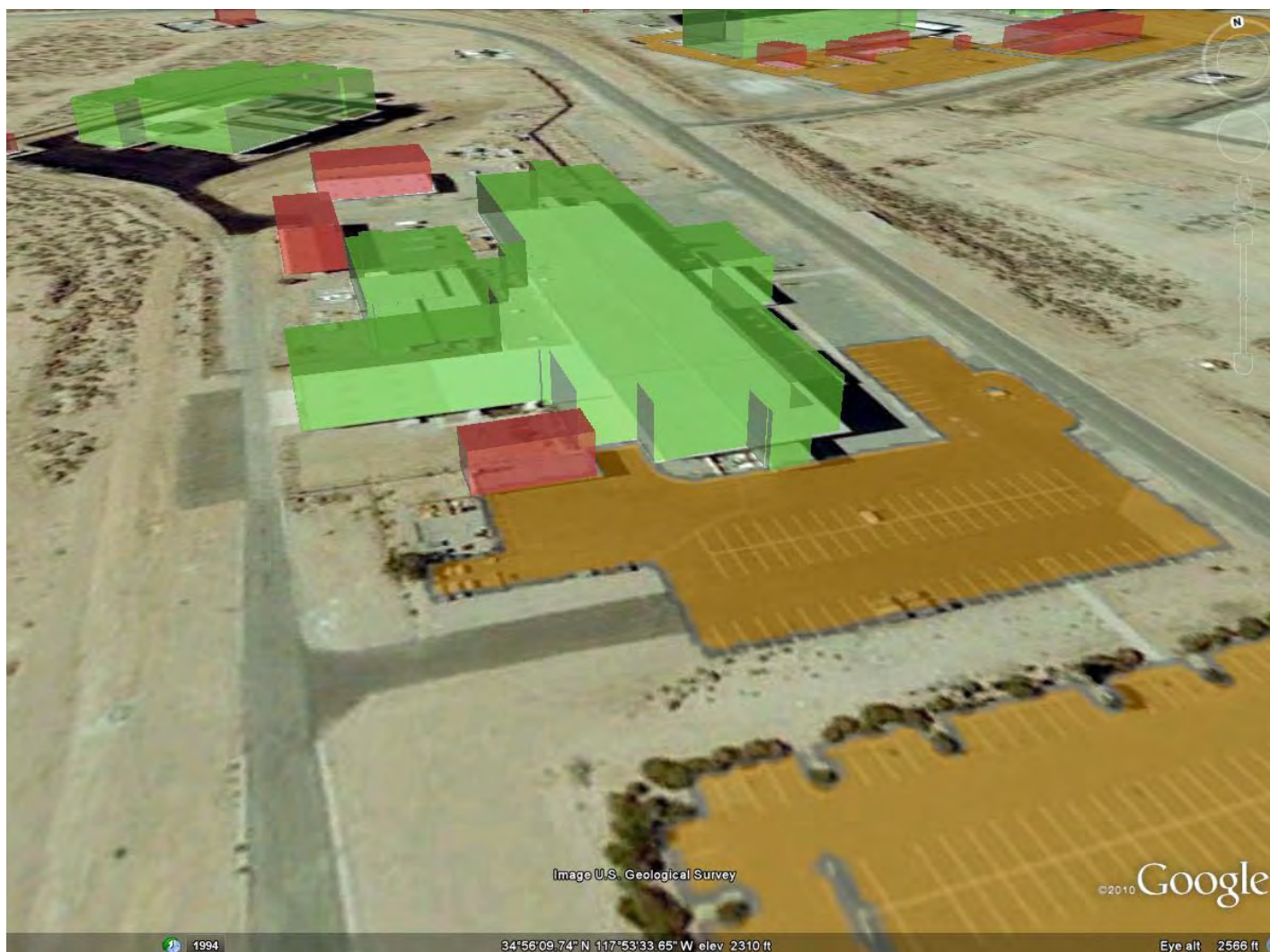
# Suitability Analysis



# Building Rooftop Analysis - Dimensional



# Building Rooftop Analysis – Slope/Orientation



# Parking Lot Shading Structure Analysis

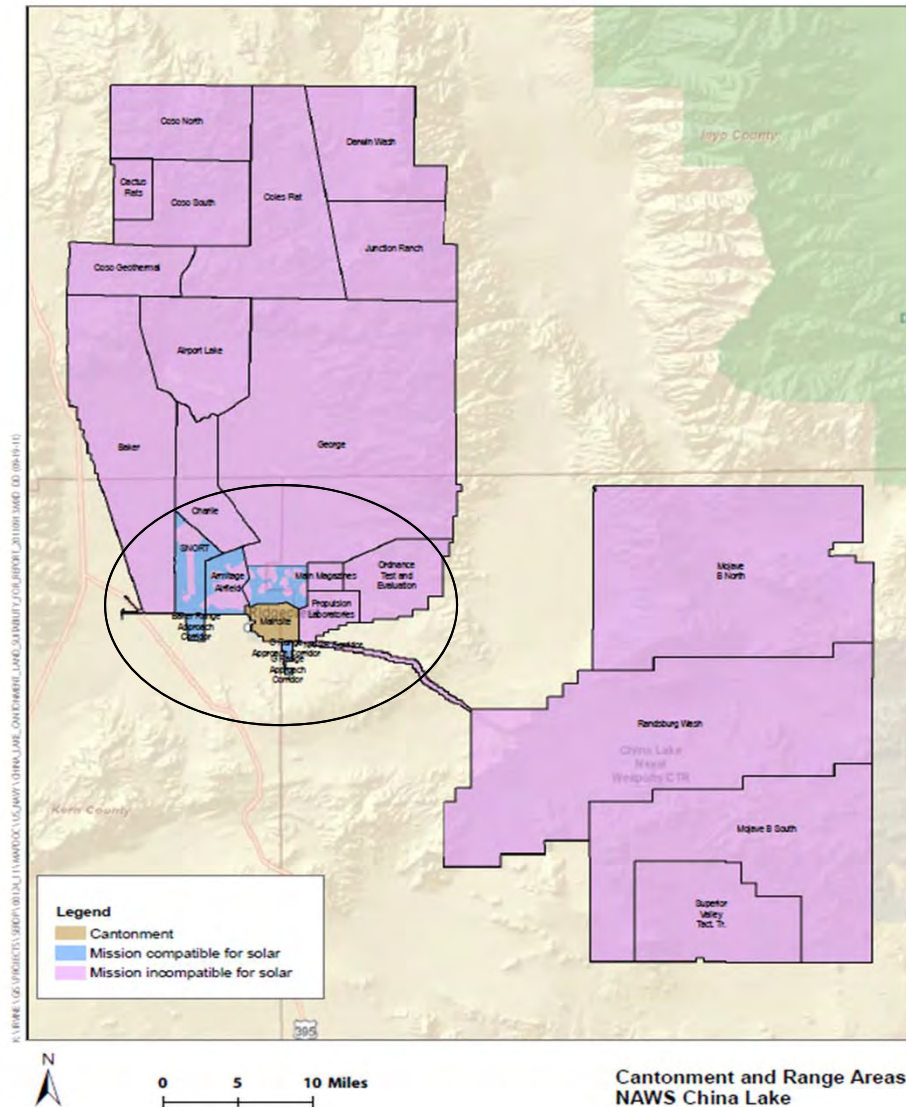


## Mission Compatibility

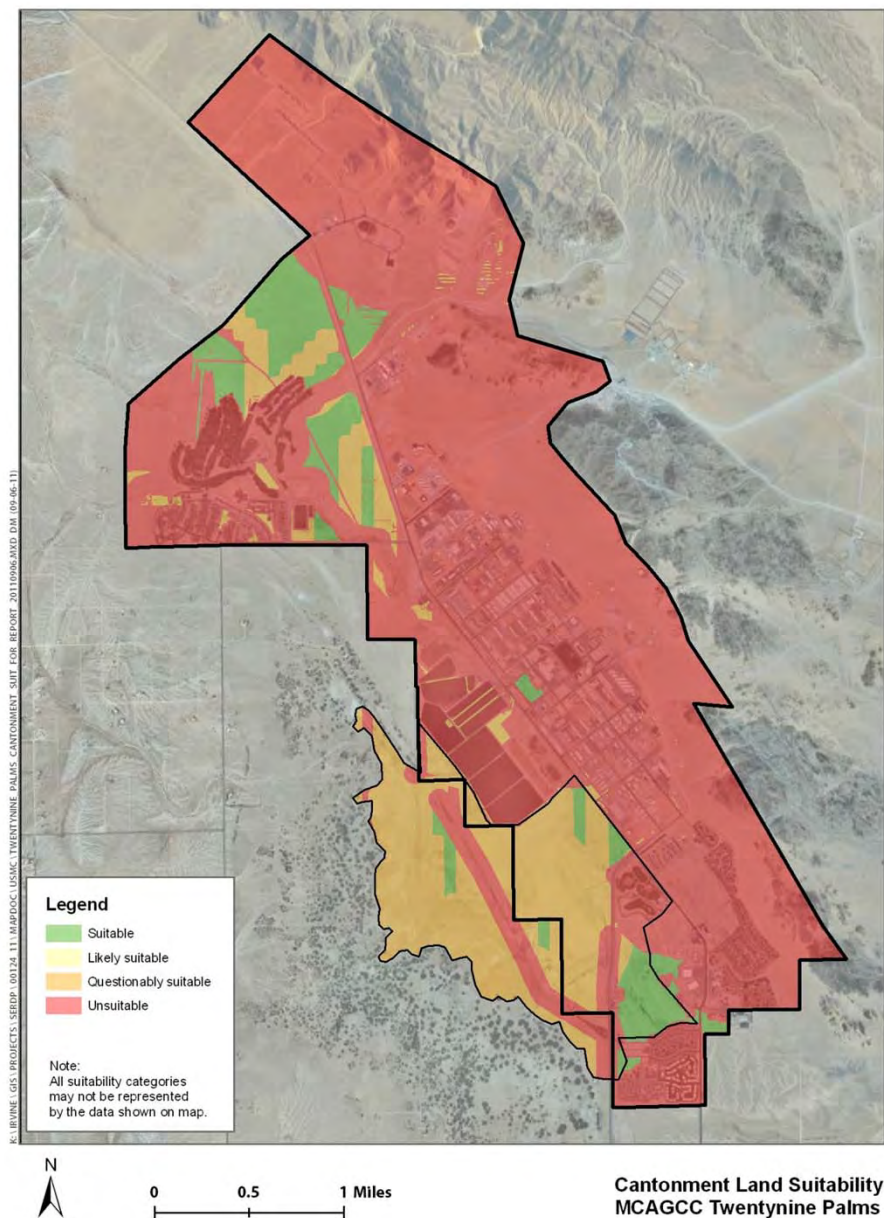
- Principal ranges rated Category 4 (Unsuitable) due to mission conflicts with training, RDT&E, ESQD arcs, etc.
  - NTTR
  - Fort Irwin
  - Twentynine Palms
  - Almost all of China Lake
- NAF El Centro ranges excluded for mission and biological concerns
- Solar potential primarily in and adjacent to cantonment areas at each installation
- Exceptions
  - Chocolate Mountain AGR - margins appear viable
  - Edwards AFB – range and cantonment areas more intermingled than at other installations
- Chapter dedicated to explaining why ranges are unsuitable

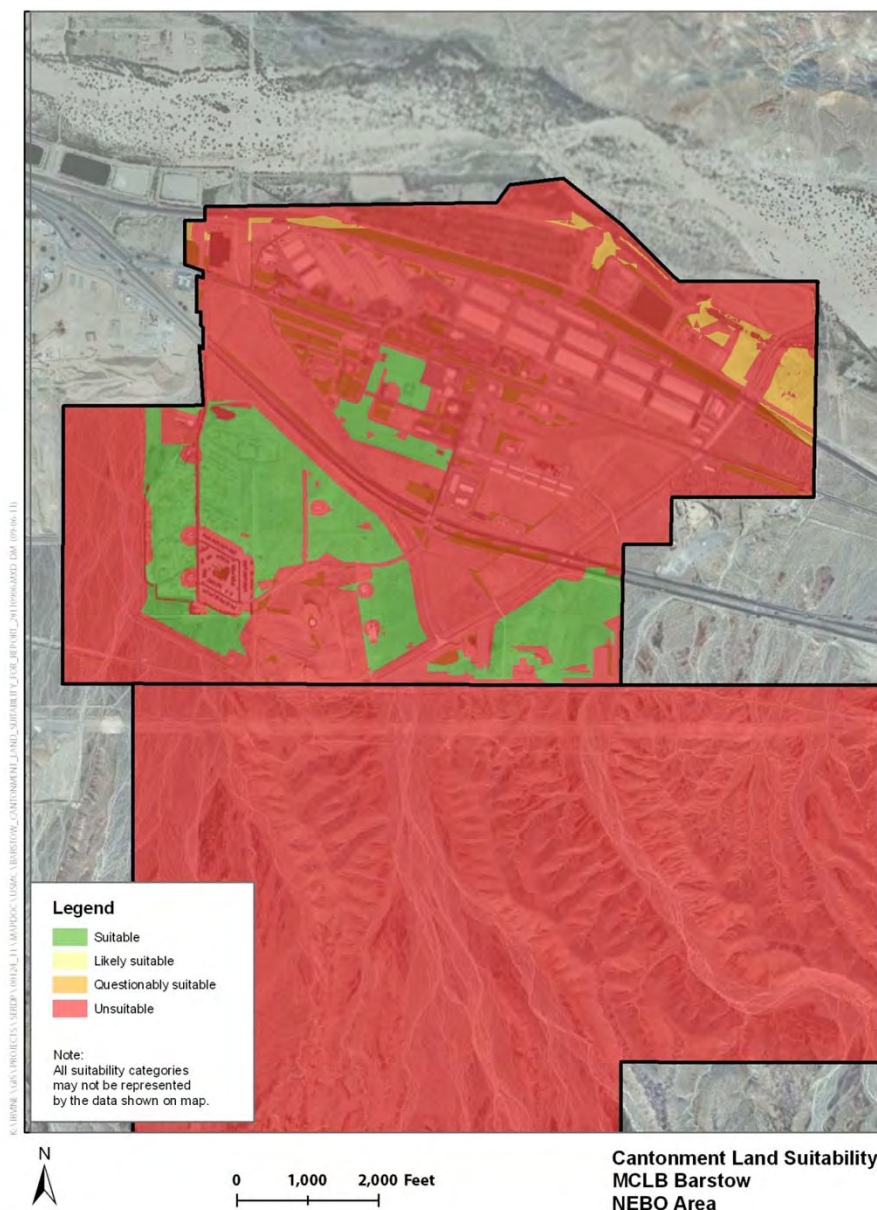
# NAWS China Lake Example

- Cantonment and close-in range
- 20 data layers including
  - Mission compatibility
  - Protected species
- Review of initial map by 9 staff
  - Base, NAVAIR, NAVFAC SW
  - Considerable feedback; integrated into current map
- 6,000 “green” acres
- 12,000 “yellow/orange” acres
- >1000 MW<sub>AC</sub> ground solar potential
- **Much of range (> 1 M acres) off-limits but still huge potential**

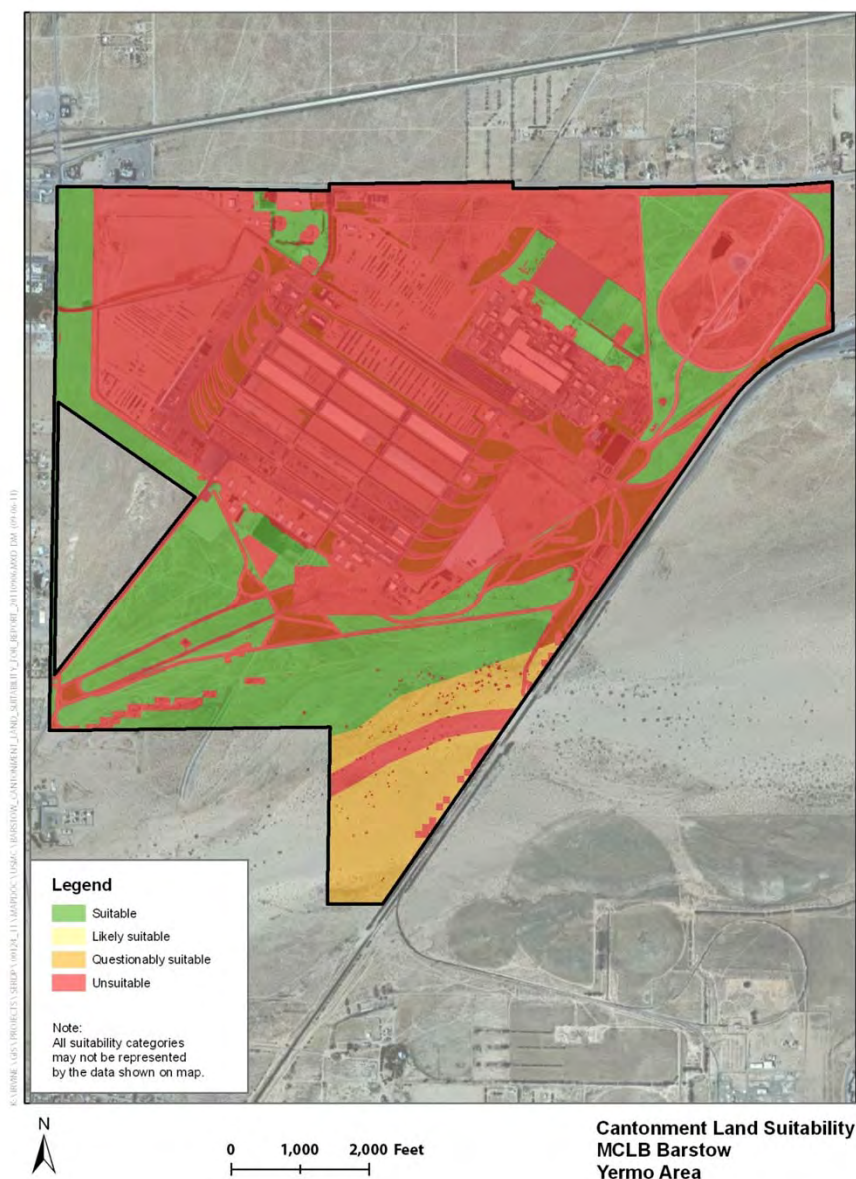


## MCAGCC Twentynine Palms

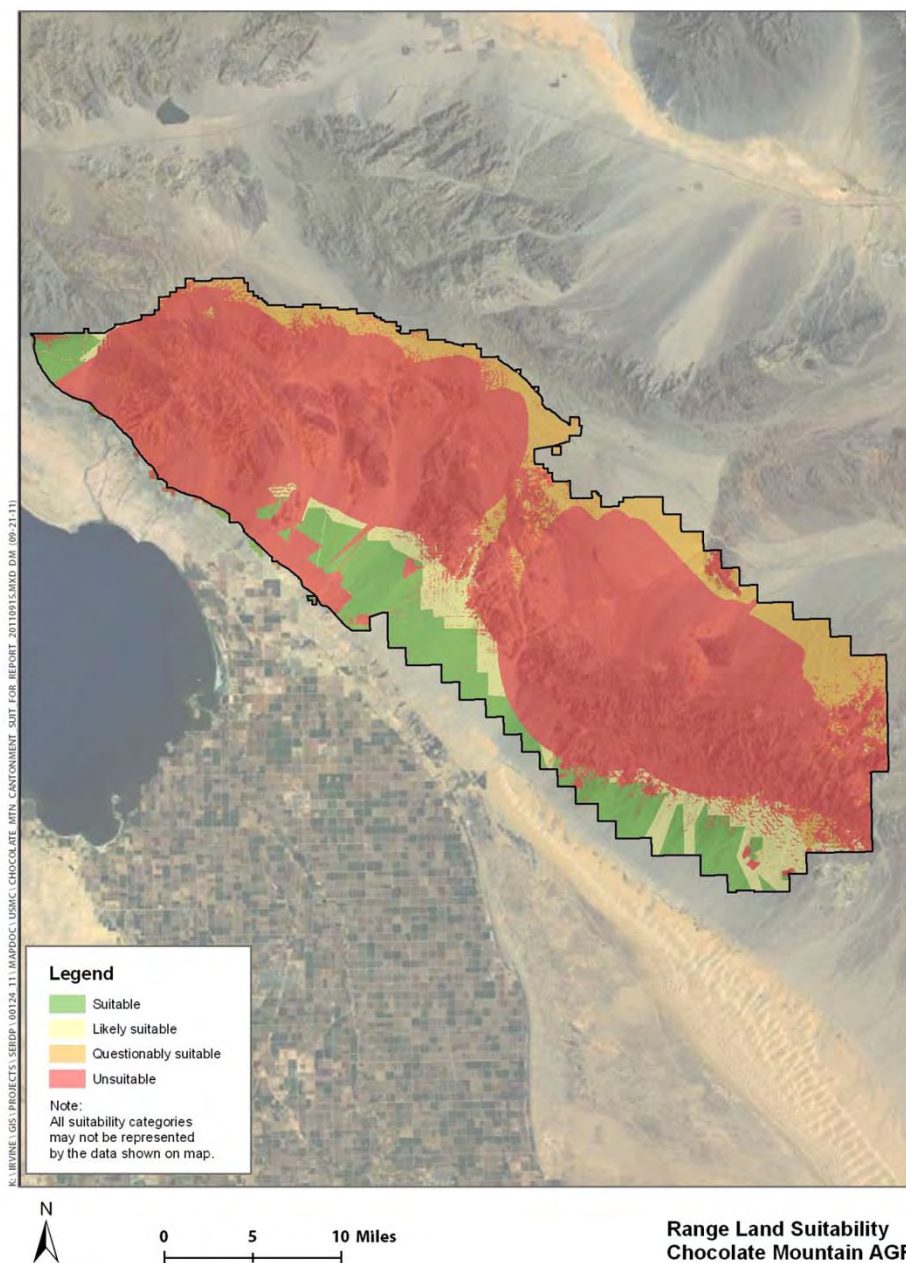




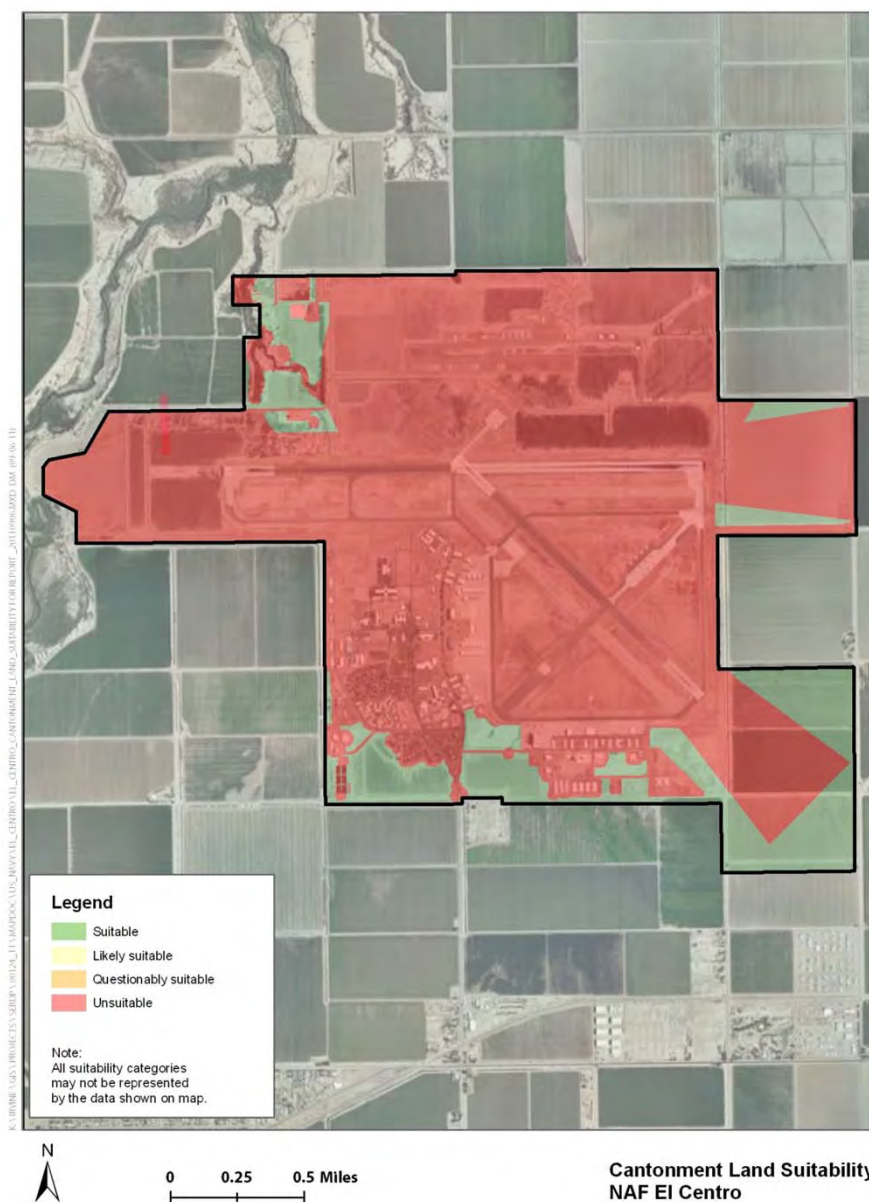
## MCLB Barstow - Nebo



## MCLB Barstow - Yermo

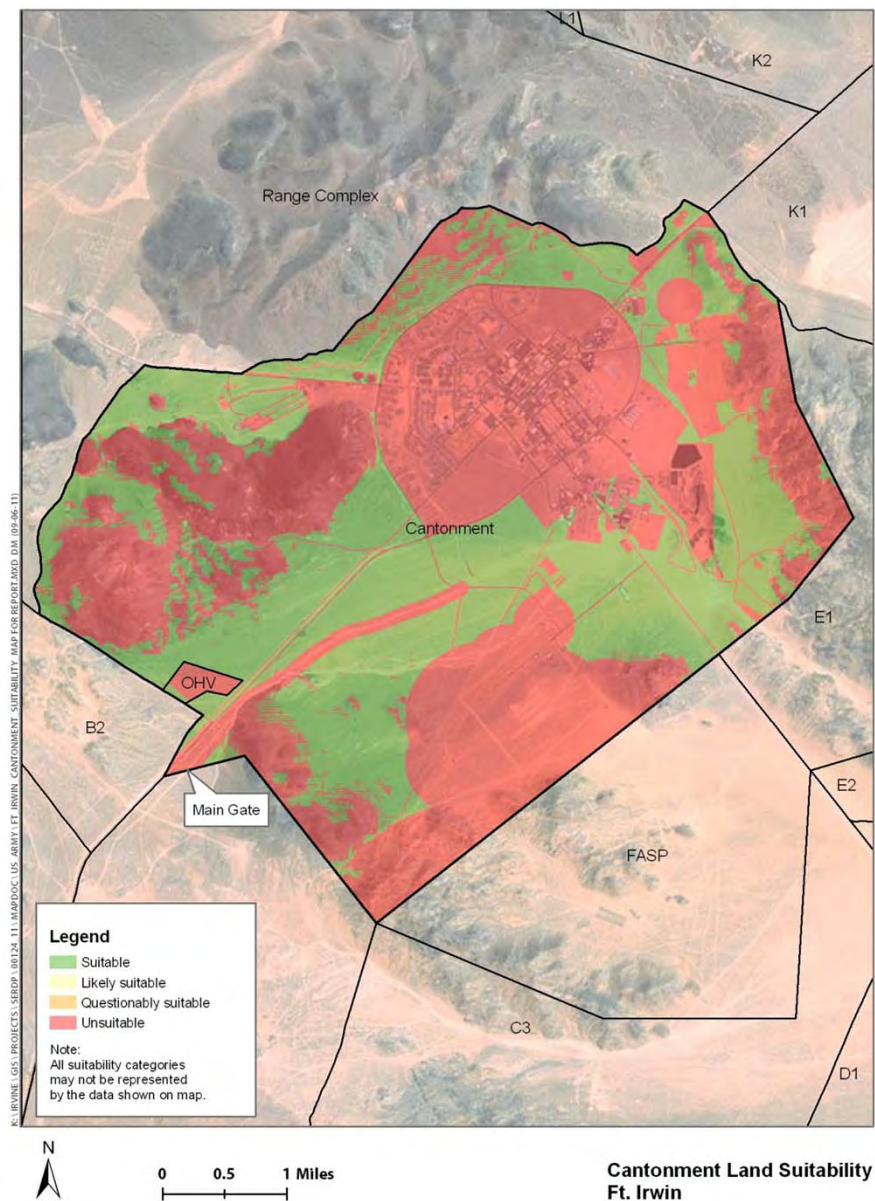


## Chocolate Mountain AGR

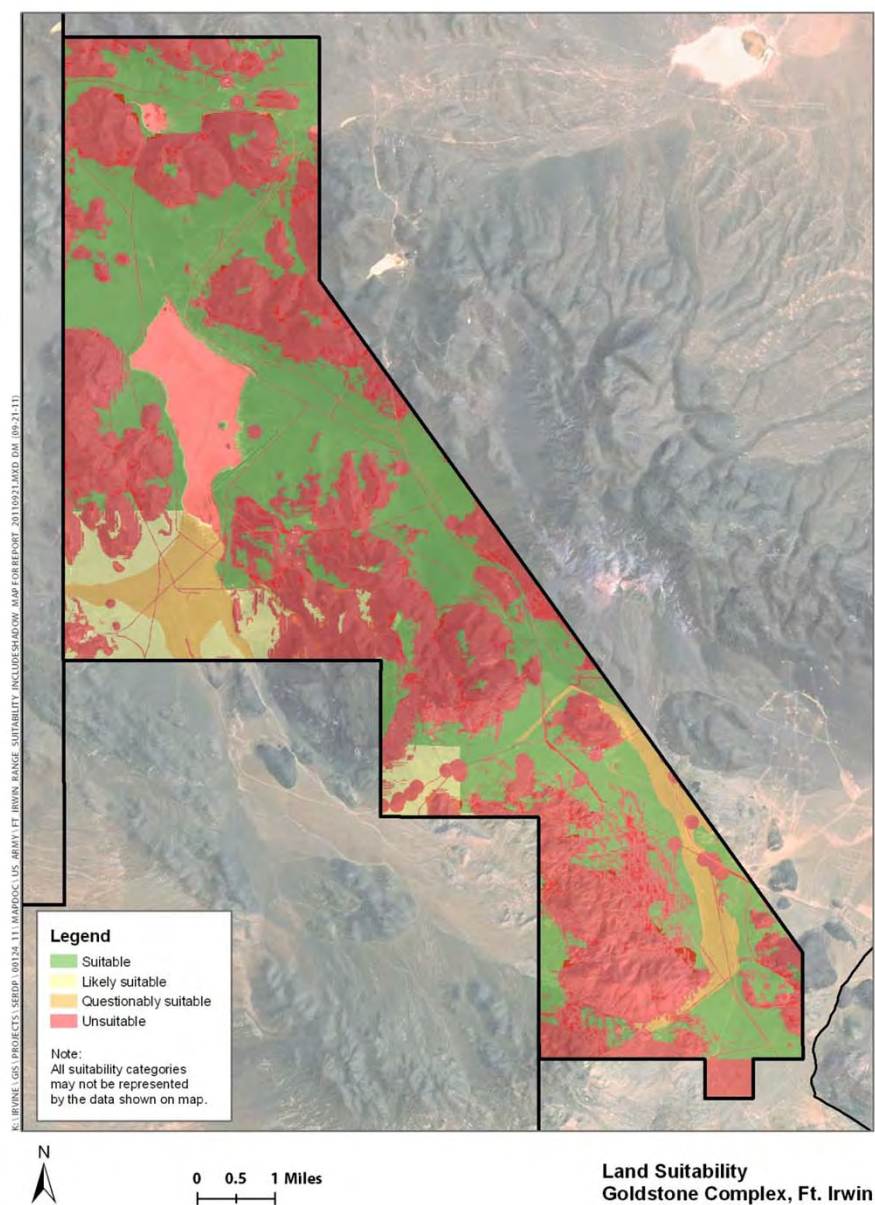


NAF El Centro





## Ft. Irwin – Cantonment and Main Gate



## Ft. Irwin – Goldstone Complex

## Technology Analysis

- Take 100% of “green” area and 25% of “yellow” and “orange” area
- Build six different solar packages on every acre (PV and CSP)
- Outputs
  - Equipment specifications (MW of each technology, defines cost)
  - Hourly electricity generation (drives revenue)
  - Water consumption

## Economic Analysis - Framework

- 20-year discounted cash flow model
- 2015 installation date
- Applied at the installation level (expense and revenue drivers vary across installations) from the project's perspective
- 5 site types
- 6 solar technologies: thin-film and crystalline PV x fixed and single-axis tracking; trough; dish/Stirling engine.
- 2 ownership structures (MILCON and 3<sup>rd</sup> party)
- Outputs: net present value (NPV) and internal rate of return (IRR)

## Economic Results

- Only third-party financing works. MILCON fails comprehensively
- All parking lot shading structures failed the economic test due to cost of building the shade canopy
- Most technically-eligible rooftop potential was economically viable
- Almost all technically-eligible ground sites were economically viable for at least one solar technology
- BLM ground rental rates could be roughly doubled and still give developer 16% IRR

## Conclusions

- Substantial solar potential available after accounting for mission compatibility, environmental and cultural resource conflicts, etc.
- DoD needs to work with private-sector developers to ensure financial viability
- Potential for significant new value to be earned by DoD and/or BLM
- Development should be accelerated to maintain access to current Federal tax credits
- Programmatic scale-up necessary and desirable

## Recommendations

- Clarify withdrawn lands policy with the Department of the Interior
- Work with stakeholders to accelerate transmission development
- Clarify DoD policy on REC ownership and accounting
- Clarify and develop programs to achieve energy security goals
- Increase coordination and integration of renewable energy projects and initiatives among military installations and Services
- Develop a consistent and incentive-focused formula to allocate project benefits and costs between the host installation and parent organizations
- Work with BLM to ensure that the Federal Government is maximizing its compensation from land rentals while allowing solar developers to make an attractive rate of return
- Implement a scaled-up and systematic development program

## Thank You



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